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The MONTHLY REVIEW

Published by the

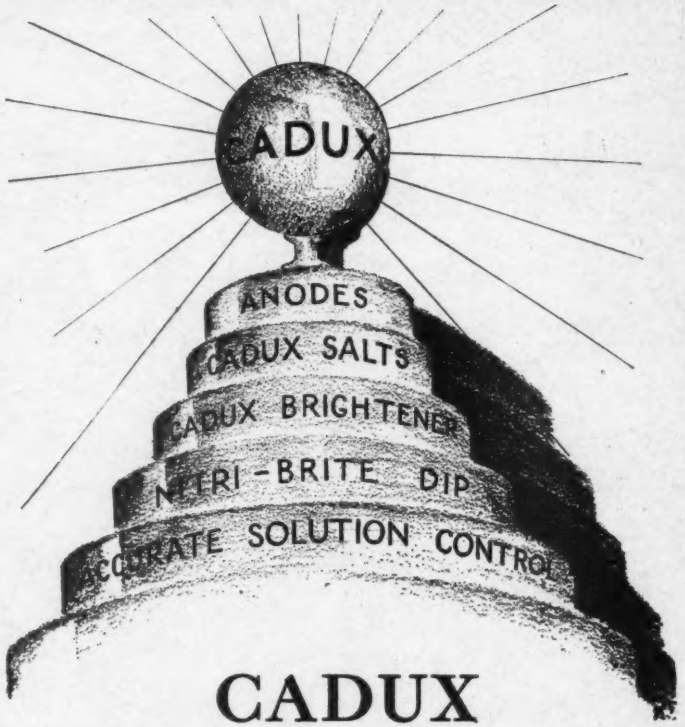
American Electro-Platers' Society

A SOCIETY FOR THE ADVANCEMENT
OF THE
SCIENCE OF ELECTRO-PLATING

SEPTEMBER, 1934 **Subscription $3.00 a year**

Entered as second class matter at the Post Office at Springfield, Mass., September 8, 1930, under Act of August 24, 1912.

Acceptance for mailing at special rate of postage, provided for in section 1103, Act of February 28, 1925, authorized September 3, 1926.



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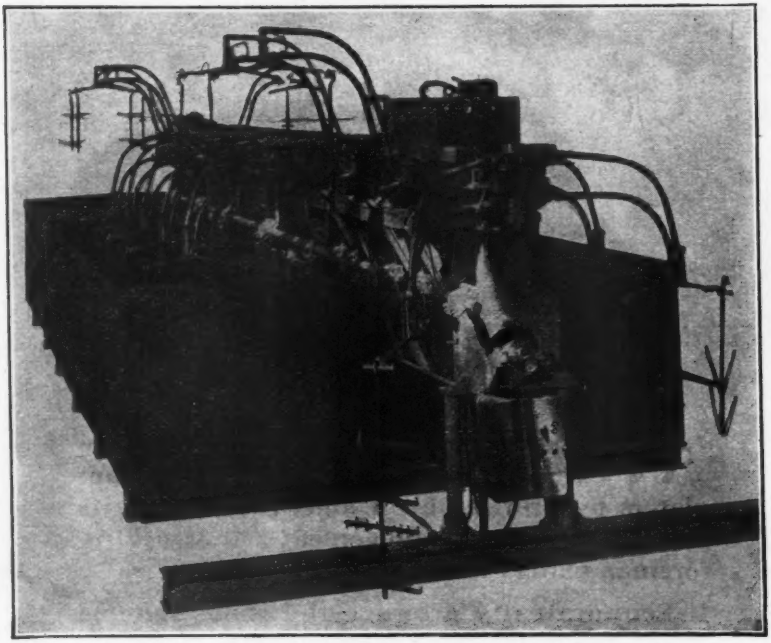

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The MONTHLY REVIEW

Published by the
AMERICAN ELECTRO-PLATERS' SOCIETY

Publication and Editorial Office
90 Maynard St.
Springfield, Massachusetts

VOL. XXI SEPTEMBER, 1934 NO. 2

SUMMARY OF RESEARCHES ON ELECTRO-PLATING AT NATIONAL BUREAU OF STANDARDS

July, 1933 to June, 1934
Read at Detroit Convention

I. FUNDS AND PERSONNEL

As a result of reduced appropriations, it was necessary on July 1, 1933 to decrease the technical staff of the section from 6 to 4 persons. As two of the latter are employed on special projects for other government departments, and most of the time of one is required for testing government purchases, it has not been possible to make much progress on researches of general interest. Most of the studies that were started have not yet been completed, so the following brief summary represents merely a progress report:

II. RESEARCHES

1. Mechanism of Chromium Plating

Further studies made by C. Kasper led to a better understanding of the actual process by which chromium is deposited from chromic acid baths. The evidence indicates that the chromium is deposited directly from a valence of six, and not from the trivalent state. Various modifications of the present bath and operating conditions that might be expected to increase the cathode efficiency or widen the plating range, were found to be ineffective. The paper will be published in the near future in the Journal of Research.

2. Use of Chromium for Wear Resistance

At the request of one of the government departments a study is being made by R. M. Wick upon the best conditions for depositing chromium for wear resistance. As this investigation will include extensive service tests, no results or conclusions will be available for some time.

3. Current Distribution in Electrodeposition

Most of the papers on throwing power that have been published from this and other laboratories assume or involve some "primary distribution" of current, which depends upon the shape, size and position of the electrodes and containing vessel. There has, however, been almost no research on the mathematical relation of this distribution to the shape or position of the article. C. Kasper has started a study of this subject by methods that appear promising, though not yet conclusive.

4. Rapid Nickel Deposition

At the request of the Bureau of Engraving and Printing, a study has been started by C. Kasper on the favorable conditions for the most rapid deposition of nickel. The results thus far obtained in small scale experiments show that it is possible to produce in a short time very thick nickel deposits that are relatively smooth and ductile. Large scale operations for a considerable period will be required to determine whether the process is commercially practicable. If successful, its value will be greatest where a thickness of 0.1 inch or more of nickel is required, but it may prove useful also for thinner coatings, such as 0.001 inch, that are applied in commercial plating.

5. Protective Value of Electro-plated Coatings

During the year, P. W. C. Strausser, Research Associate of the American Electro-Platers' Society, extended and confirmed the previous work on methods of stripping metal deposits and testing them for porosity. The results for nickel and chromium coatings have been summarized in a separate report to this convention, and will be published in detail in the Journal of Research in the near future. A progress report will be made on the zinc and cadmium coatings, the final results of which will not be published until further data are obtained.

III. TESTING

During the year, M. R. Thompson has tested a large number of plated articles purchased by various government departments. Among such articles are chromium plated hardware and plumbing fixtures, zinc plated conduit, silver plated table ware, and tinned paper clips. In addition, galvanized iron, terne plate, lead coated copper and other coated metals have been tested. Plating solutions have been analyzed for the Bureau of Engraving and Printing and the War Department.

Federal specifications for plating and the tests made on deliveries will be discussed in a separate paper by M. R. Thompson.

IV. FUTURE PLANS

With the limited funds appropriated to the Bureau for this section, an effort will be made to study those fundamental principles, such as throwing power, that may be of value in all electrodeposition. Practical problems will be undertaken at the request of different government departments. In most cases the results of the completed investigation will be made available to the public.

It has been proposed to extend the exposure tests to include plating on non-ferrous metals, such as copper, brass, zinc, and die castings. If the interest of platers and manufacturers in this project is sufficient to retain the services of the research associate, the Bureau will cooperate in every possible way in the completion of such a program. (Applause)

CHAIRMAN THOMPSON: Dr. Blum suggests that we incorporate the discussion of the first three papers into one period and, with that suggestion in mind, we will now go on to the report of our Research Associate at the Bureau, his "Report of Exposure Tests on Plated Steel." Mr. Strausser. (Applause)

MR. P. W. C. STRAUSSER: Mr. Chairman, Fellow-Members and Friends of the American Electro-Platers' Society: It gives me great pleasure to see a number of my former associates here this afternoon. One of them came up to me a few minutes ago and said, "Strausser, we have you on the spot now."

I said, "All right, Mister; bring on your guns. I'm ready."

It certainly is indeed a great pleasure to be able to present, at this time, a somewhat more conclusive report, although in abstract form, on the protective value of plated coatings on steel. The results and conclusions presented here have been based on observations made of these specimens of over two years of outdoor exposure, and under different climatic conditions.

Now, as Dr. Blum and Mr. Hogaboom have delivered a number of these talks dealing with this subject before a number of branches during the past six months, I will endeavor to present these data in as concise a form as possible and therefore leave more time for such open discussion as may ensue.

SUMMARY
PROTECTIVE VALUE OF PLATED COATINGS ON STEEL

W. Blum, P. W. C. Strausser and A. Brenner

I. INTRODUCTION

Most of the specimens with a nickel or chromium finish have failed badly after two years exposure in the four severe locations, but only those with coatings less than 0.001 inch thick have failed at State College and Washington. The exposure tests, accelerated corrosion tests and stripping methods for nickel and chromium will be reported in detail in the Journal of Research of the National Bureau of Standards and will be summarized briefly in this report as a basis for questions and discussion.

The zinc and cadmium coatings have failed badly only in New York and Pittsburgh. Final publication regarding them will be reserved till more data are available, but the results in an industrial atmosphere will be referred to briefly in this report.

II. EXPOSURE TESTS

A. Nickel and Chromium Finish

The results with nickel and chromium led to the following conclusions:

1. The protective value of nickel coatings depends principally upon their thickness. At least 0.001 inch is required for good protection in severe exposures and at least 0.0005 inch in mild exposures.

2. The conditions of nickel deposition have very little effect on the protection against corrosion.

3. An initial or intermediate layer of copper reduces the protective value of thin coatings, but if the total thickness is 0.001 inch or more, the copper is not detrimental, especially if chromium is finally applied.

4. The conditions of copper deposition have very little effect, but if the copper is buffed before the nickel is applied the protective value is slightly increased above that of unbuffed copper.

5. A very thin layer of chromium, such as 0.00001 inch, usually decreases the protective value of nickel deposits. The customary thickness of 0.00002 to 0.00003 inch of chromium adds very little to the protection against corrosion, but it increases the resistance to tarnish. Thicker chromium deposits

such as 0.00005 or 0.0001 inch increase the protection against corrosion, especially in an industrial atmosphere.

6. A layer of zinc or cadmium under nickel or chromium tends to produce white stains and blisters.

B. Zinc and Cadmium Coatings

1. In all atmospheres thin coatings of either zinc or cadmium furnish better protection against corrosion than thin coatings of copper, nickel, and chromium.

2. In an industrial atmosphere cadmium lasts only about two-thirds as long as an equal thickness of zinc.

3. In two years there has been practically no failure of even thin coatings (0.00002 inch) of either zinc or cadmium in purely marine or rural exposure.

III. POROSITY AND ACCELERATED TESTS

A. Nickel and Chromium

As the protective value of copper, nickel and chromium deposits depends principally upon their freedom from porosity, any reliable test for porosity will distinguish between good and poor coatings.

The Ferroxyl test, for example with ferroxyl paper, serves to detect pores in a few minutes by the production of blue spots.

The salt spray and intermittent immersion tests also serve to detect pores, but require 24 to 100 hours. The number and size of the rust spots after a definite period such as 100 hours, is a better index of quality than the time required for the first appearance of rust.

It is difficult to specify quality in terms of any of these tests because it is hard to define the number and size of pores that are significant. The tests are better suited to compare similar coatings than different kinds of coating.

B. Zinc and Cadmium

1. The salt spray and intermittent immersion tests both serve to distinguish between good and poor coatings of either zinc or cadmium.

2. Cadmium coatings of a given thickness last much longer than zinc in salt spray or intermittent immersion, but this result has no bearing on their relative value in an industrial atmosphere.

IV. STRIPPING METHODS

Methods for stripping copper, nickel or chromium from steel

were presented at the last convention and were published in the Monthly Review for November, 1933. Further application of these methods during the past year has in general confirmed the previous conclusions, and in some cases has led to slight modifications or precautions. These will be included in the report in the Journal of Research.

Methods for stripping zinc and cadmium coatings will be included in the complete report upon them, to be published later.

Now, I want to say that this project did have a specific purpose. I want to give the reasons, my personal reasons. I am of the opinion that these conclusions drawn here should now set our minds at rest in differentiating between a good and a poor quality of coating. I believe that I can say in safety that heretofore many of these plating specifications have been formulated purely on a hypothetical basis, or they probably used one or two tests as a criterion, or the salt spray alone.

This statement is somewhat borne out by the fact that a recent investigation conducted by the automotive industry shows that at least eight automotive concerns have different (and some quite widely different) plating specifications. For example, the plating of zinc base die castings. I am not ashamed to admit that I was often in a quandary when called upon to set up plating specifications.

This piece of research on the "Protective Value of Plated Coatings on Steel" and the results obtained therefrom I believe in all sincerity will be welcomed, especially by those connected directly in the formulating of plating specifications A further appreciation of this work will no doubt be realized by all of you when we take into consideration that the conclusions drawn from these results have been based on over 100,000 individual ratings of specimens.

In conclusion, I wish to state that I am of the firm opinion that with the data now available we will be able to return back home with a feeling of more security in knowing that we can and will be able to produce a deposit as good, both in cost and quality, if not better than some of the much-advocated non-corrosive ferrous materials.

TESTING OF PLATED METALS FOR COMPLIANCE WITH FEDERAL SPECIFICATIONS

By M. R. Thompson

ABSTRACT

PUBLICATION approved by the Director of National Bureau of Standards of the United States Department of Commerce.

This paper summarizes the results of tests of the average thickness of the following electroplated coatings; (a) chromium, or chromium and nickel, on nickel-brass and brass plumbing fixtures and hardware; (b) silver on flat tableware; and (c) zinc on electrical conduit.

The earliest recorded tests at this Bureau were made in 1924 on silver-plated tableware. The number of tests of all kinds listed is 890. The record for the three larger groups shows that in general the specifications were met most often by silver plating, next by chromium plating and least often by nickel plating. The specifications were met more frequently by plumbing fixtures than by hardware.

I. INTRODUCTION

In recent years specifications for the thickness of plated coatings have come into extensive use, especially in the automobile industry. At present there is a demand for the standardization of such specifications, so that they will be uniform, or at least consistent, for different plated articles that are subjected to similar conditions of service. To meet this demand, a joint committee of the American Electro-Platers' Society and the American Society for Testing Materials is now engaged in the preparation of standard specifications for plating on steel for automotive and other applications.

In any effort to estimate the value of specifications for plating, it is necessary to know whether typical specifications satisfactorily protect the users, and whether they can be readily met by the manufacturers. This paper summarizes ten years of experience by the Federal Government in procuring materials plated in a specified manner. The tests were made at the National Bureau of Standards. Unfortunately, it is not possible to learn the behavior of specific lots in service, but the periodic revisions of the specifications reflect in general terms the re-

ported experience with materials meeting the previous requirements.

Silver-plated tableware was tested as early as 1924, but few samples of this class were received until late in 1927. Plumbing fixtures were tested first in 1929, electrical conduit in 1930 and hardware in 1931. This work has been done successively by T. P. Sager, R. B. Rudy, A. Brenner, and recently by the writer.

The results of these tests have been summarized in this paper as well as the available information permits. Electroplaters were, of course, responsible for the finishing of the material and they should, therefore, be interested to learn how well they met the requirements and what precautions are needed for still better compliance.

Most of the specifications to be discussed in this paper are based on the amount or average thickness of the coating. The data (except a few on conduit) are confined to coatings on nickel-brass (white metal) and brass. Very few samples of chromium- or nickel-plated steel have been tested. Hot-dipped zinc and lead coatings have also been tested, but are outside of the scope of this paper.

II. RESULTS ON PLATED COATINGS

1. Plumbing Fixtures (Chromium- and Nickel-Plated)

a. Nickel-brass (white metal)

The base metal of these fixtures, according to kind, contains from 15 to 20 per cent of nickel. Until August, 1933, specifications usually called for a direct coating of 0.0002 inch of chromium. Present requirement is shown in Table 11 (Page 22). The chromium plating is generally applied directly, although preliminary nickel plating is optional with the manufacturer. To determine the thickness of the chromium plating, the specimen is measured and its area computed as accurately as possible. The amount of chromium is determined by loss in weight on treatment with hot dilute hydrochloric acid (10 per cent of concentrated acid by volume.) The average thickness of the chromium coating is then calculated from the loss in weight and the area. Tests are not ordinarily made on the nickel coating.

The results of tests on this class of material are shown by years in Table 1 and by kind in Table 2. Most of the samples represented material to be used in the new Government buildings in Washington and in post offices and court houses throughout the country. No attempt at a comparison of performance

by manufacturers (anonymously) will be made here or throughout this paper, because of the large proportion of samples of origin unknown to us.

TABLE I

Chromium-Plated Nickel-Brass Plumbing Fixtures
Results by Years

Year	Specimens tested Number	Specimens passed		Lots tested Number	Lots passed	
		Number	%		Number	%
1929 to 1931	22	13	59	4	2	50
1932	58	33	57	16	9	56
1933	68	60	88	22	16	73
1934*	15	15	100	4	4	100
Total	163	121	74	46	31	67

*Values for 1934 in this and other tables are up to May 1.

TABLE II

Chromium-Plated Nickel-Brass Plumbing Fixtures
Results by Kind (1929 to 1934)

Kind	Specimens tested Number	Specimens passed	
		Number	%
1. Pipe and nipples	55	38	69
2. Pipe fittings	16	11	69
3. Faucets and valves	37	29	78
4. Flanges, canopies, etc.	30	23	77
5. Miscellaneous	25	20	80
Total	163	121	74

b. Discussion

There has been a consistent improvement in the plating on these plumbing fixtures from year to year. At present, no difficulty is apparently experienced in meeting the specification of a minimum average thickness of 0.00009 inch chromium (which is, however, less stringent than previous specifications). Actually, the average thickness of the coatings is usually much greater.

Slightly more difficulty appears to have been found in plating pipe, nipples and pipe fittings than other articles. This is surprising, because their simple shape would seem to favor the production of a definite thickness.

TABLE III
Chromium- and Nickel-Plated Brass Plumbing Fixtures
Results by Years
(All specimens were tested for chromium. All specimens having a preliminary coating of nickel were also tested for nickel.)

Year	Specimens Tested	Specimens passed on chromium		Lots tested	Lots passed on chromium		Nickel specimens	Specimens passed on nickel		Lots tested	Lots passed on nickel	
	Number	Number	%	Number	Number	%	Number	Number	%	Number	Number	%
1929	19	19	100	5	5	100	1	1	100	1	1	100
1930	23	17	74	10	8	80	14	6	43	8	2	25
1931	0	..	..	..	..	..	..	..	..	..	..	..
1932	21	11	52	10	5	50	15	8	53	9	3	33
1933	6	4	67	2	1	50	6	4	67	2	2	100
1934	0	..	..	..	..	..	..	..	..	..	..	..
Total	69	51	74	27	19	70	36	19	53	20	8	40

TABLE IV
Chromium- and Nickel-Plated Brass Plumbing Fixtures
Results by Kind (1929 to 1934)
(All specimens were tested for chromium. All specimens having a preliminary coating of nickel were also tested for nickel).

Kind	Specimens tested	Passed on chromium		Nickel specimens tested	Passed on nickel	
	Number	Number	%	Number	Number	%
1. Pipe and nipples	18	12	67	8	6	75
2. Pipe fittings	13	8	62	9	3	33
3. Faucets and valves	14	13	93	6	2	33
4. Flanges, canopies, etc.	9	8	89	3	2	67
5. Miscellaneous	15	10	67	10	6	60
Total	69	51	74	36	19	53

c. Brass and Bronze

The composition of these fixtures and other requirements are given in Federal Specification WW-P-541. The present plating requirement is given in Table 11. In testing, the area of the sample is measured and then the chromium determined as before by the loss in weight after stripping in hot dilute hydrochloric acid (10 per cent of concentrated acid by volume.) Following this, the nickel is stripped anodically in hydrochloric acid of the same strength and determined in the resultant solution, usually by the dimethylglyoxime method.

The results of tests of samples in this class are presented by years in Table 3 and by kind in Table 4. (See page opposite).

d. Discussion

The record for this class of plumbing fixtures is rather variable. Both chromium and nickel coatings passed well in 1929, but subsequently the failures increased. On the whole, more trouble has been found with nickel than with chromium plating. No samples have been received recently, but the record suggests that greater care may be needed to meet the requirements. Just as with nickel-brass plumbing fixtures, somewhat more difficulty was experienced in chromium plating on brass pipe, nipples and pipe fittings than on other brass fixtures. With nickel plating, however, the greatest difficulty was observed with pipe fittings, faucets and valves.

2. Hardware (Chromium- and Nickel-Plated)

a. Nickel-Brass

Previous to 1933, the specification for plating on nickel-brass hardware was the same as for brass and bronze hardware, namely, 0.00002 inch of chromium over 0.0001 inch of nickel. The present specification for direct chromium plating is given in Table 11 (page 22). The method of testing is the same as that for plumbing fixtures.

The record of results by years is presented in Table 5 and by kind in Table 6 (see page 16).

b. Discussion

Few samples of chromium-plated nickel-brass hardware were received. The record is uniformly unsatisfactory by years and also by kind. The greatest difficulty was found with hinges and other door trim. It is evident that more care and closer control will be required to improve upon this record.

TABLE V
Chromium-Plated Nickel-Brass Hardware

Results by Years

Year	Specimens tested Number	Specimens passed		Lots tested Number	Lots passed	
		Number	%		Number	%
1931	4	3	75	2	1	50
1932	11	7	64	7	4	57
1933	14	6	43	4	2	50
1934	0	..	..	..	..	..
Total	29	16	55	13	7	54

TABLE VI
Chromium-Plated Nickel-Brass Hardware

Results by Kind (1931 to 1934)

Kind	Specimens tested Number	Specimens passed	
		Number	%
1. Hinges	5	2	40
2. Other door trim	8	3	38
3. Floor flanges	2	1	50
4. Tubing	5	3	60
5. Miscellaneous	9	7	78
Total	29	16	55

c. Brass and Bronze

In earlier years, an occasional lot of this hardware was admitted under the same requirement as for nickel-brass plumbing fixtures, namely, 0.0002 inch of chromium plated directly. The present specifications are given in Table 11. The methods of determination are the same as for plumbing fixtures.

The record by years is presented in Table 7. The variety of samples was too great to permit a satisfactory analysis by kind.

d. Discussion

A larger number of chromium- and nickel-plated brass hardware samples was received than of the similar plumbing fixtures. The record for chromium plating was also poor, but slightly better than for the nickel-brass hardware. The record for the nickel plating has been very poor. In general, the plating on hardware did not meet the specifications as well as that on plumbing fixtures, in spite of the fact that the required thickness was usually less for the hardware.

TABLE VII

Chromium- and Nickel-Plated Brass Hardware

Results by Years

(All specimens were tested for chromium. All specimens having a preliminary coating of nickel were also tested for nickel)

Year	Specimens tested	Specimens passed on chromium		Lots tested	Lots passed on chromium		Nickel specimens tested	Specimens passed on nickel		Lots tested	Lots passed on nickel	
	Number	Number	%	Number	Number	%	Number	Number	%	Number	Number	%
1929	13	11	85	6	4	67	11	5	45	4	2	50
1930	18	10	56	13	8	62	16	1	6	12	1	8
1931	13	12	92	4	3	75	13	8	62	4	2	25
1932	18	8	44	5	3	60	18	8	44	5	2	40
1933	1	1	100	1	1	100	1	1	100	1	1	100
1934	0	..	..	..	..	..	..	..	..	..	..	..
Total	63	42	67	29	19	66	59	23	39	26	7	27

TABLE VIII

Specifications for Silver-Plated Tableware[1]

(Figures in parenthesis indicate proposed changes)

Class	Average thickness of silver inch	Weight of silver Troy oz. sq.ft	Weight of Silver Troy oz. gross	Approx. area of one piece sq. in.
Flatware and hollow ware for frequent use	0.0008 (0.00125)	0.64 (1.0)		
Flatware				
1. Dessert forks	....	....	8 (15)	9
2. Dinner forks	....	....	10 (20)	11
3. Tea knives (hollow handle)	....	....	6	10
4. Dessert knives (hollow handle)	....	....	10 (15)	15
5. Dinner knives (hollow handle)	....	....	12 (20)	19
6. Dinner knives (hollow handle; handle only)	....	....	6 (10)	9
7. Dinner knives (solid handle)	....	....	10 (17)	17
8. Dinner knives (solid handle) (or) (handle only)	....	....	3.5	5.5
9. Dinner knives (solid handle; handle only)	....	....	5 (8)	7
10. Teaspoons	....	....	6 (9)	9
11. Dessert spoons	....	....	9 (15)	13
12. Soup spoons	....	....	9 (15)	14
13. Tablespoons	....	....	12 (20)	17
Flatware and hollow ware for occasional use[2]	0.0006	0.48		
Reinforcement (backs of spoon bowls and fork tines)	0.0012 (0.0018)			

[1]Tableware; Silver-Plated, RR-T-51, July 21, 1931. Obtainable for five cents (stamps not accepted) from Superintendent of Documents, Washington, D. C.

[2]No distinction in proposed specification.

3. Tableware (Silver-Plated)

While a certain average thickness of silver plating on tableware is desired, the requirements are customarily expressed on a weight basis, for example as a certain number of troy ounces of silver per gross of a given article, depending on its area. The specifications are summarized in Table 8. (Page 18). Changes proposed in January, 1934, and now under consideration, are added in parenthesis. They will require considerably more silver than the present specification.

The blanks for spoons and forks are required to be of 18 per cent nickel-brass (nickel-silver) with a minus tolerance of 1 per cent of nickel permitted. Hollow handles of knives are nickel-brass and solid handles are steel. Unless silver-plated knife blades are specified, the blades are of corrosion-resisting cutlery steel (14 per cent chromium). The weight of the blanks for each kind of flatware is specified in avoirdupois ounces per dozen.

Sampling of flatware or hollow ware is done by taking one piece from each gross or less and testing for weight of silver. If the weight of silver on this specimen is more than 15 per cent below the specified value, two or more additional specimens are taken. Unless the average of the three pieces is within a minus tolerance of 5 per cent, the shipment fails. One piece from each gross or less of spoons and forks is tested for thickness of reinforcing or overlay.

The weight of silver is determined by loss in weight on stripping. Specimens with a nickel-brass base are stripped chemically in a hot mixture of nitric and sulphuric acids. Samples with a steel or white metal (britannia) base are stripped anodically in a cyanide solution. Thickness measurements on the backs of spoon bowls and fork tines at the point of reinforcement are made by customary microscopic methods. Further details on testing will be found in RR-T-51. No hollow ware samples have been received.

The record by years is presented in Table 9 and by kind in Table 10. (Pages 20 and 21.)

TABLE IX

Silver-Plated Tableware (Flatware)

Results by Years

Year	Specimens tested for weight of silver Number	Passed on weight		Specimens tested for thickness[1]	Passed on thickness		Lots tested	Lots passed		Lots failed on	
		Number	%	Number	Number	%	Number	Number	%	Weight Number	Thickness Number
1924-26	13	12	92	0	..	..	3	3	100	0	0
1927	53	47	89	10	10	100	5	4	80	1	0
1928	77	77	100	13	13	100	8	8	100	0	0
1929	66	51	77	7	6	86	8	6	75	1	1
1930	66	66	100	30	13	43	22	13	59	0	9
1931	17	16	94	2	1	50	3	3	100	0	0
1932	155	142	92	29	17	59	31	24	77	3	6[2]
1933	..	..	..	..	..	..	..	..	..	..	..
1934	..	..	..	..	..	..	..	..	..	..	..
Total	447	411	92	91	60	66	80	61	76	5	16

[1]Different samples are used for thickness and weight tests.
[2]Includes 2 lots also failing on weight.

TABLE X
Silver-Plated Tableware

Results by Kind
(1924 to 1934)

Kind	Specimens tested for weight	Passed on weight		Specimens tested for thickness	Passed on thickness	
	Number	Number	%	Number	Number	%
1. Spoons	270	259	96	74	49	66
2. Forks	70	64	91	17	11	65
3. Knives	107	88	82	..	..	..
Total	447	411	92	91	60	66

The record for silver-plated tableware is much better than for any of the other plated commodities listed in this paper, being particularly good on the weight of silver. Most of the specimens that failed were spoons and forks which lacked the required thickness at the reinforced portion. This weakness has been somewhat greater in recent years. Distinct improvement is needed in this respect, especially to meet the proposed requirement, which is 50 per cent greater.

The probable reason for silver plating having shown a better record for weight (or average thickness) than chromium or nickel plating are (a) greater specialization, (b) simpler shapes of articles, (c) the greater cost of the deposited metal, which has led to closer control, and (d) the more prevalent use of specifications for silver plating.

The compliance with respect to weight and composition of the base metal blanks was usually excellent.

4. Electrical Conduit (Zinc-Plated)

From 1930 to 1933, inclusive, 28 samples of zinc-plated electrical conduit were received and tested by means of the Preece test, which is a measure of minimum thickness of coating. The procedure involves giving the specimen successive one-minute immersions in neutral copper sulphate solution having a specific gravity of 1.186 at 65°F, and washing and wiping the sample after each immersion. When bright adherent copper is observed to cover ten per cent of the area, failure of the zinc coating has occurred. The quality is rated by the number of immersions withstood before failure. Either 4 or 6 immersions were required for the specimens mentioned.

TABLE XI

Present Specifications on Chromium- and Nickel-Plated Plumbing Fixtures and Builders' Hardware (1934)

Class	Base Metal	Chromium inch	Nickel inch	Fed. Spec. Number	Remarks
Plumbing fixtures	nickel-brass	0.00009	optional	WW-P-541[1]	No tolerance[6]
Plumbing fixtures	brass or bronze	.000018	0.00018		
Builder's hardware	nickel-brass	.0001	..	FF-H-106[2] FF-H-111[3]	individual minus tolerance of 20%
Builder's hardware	brass or bronze	.00002	.0001	FF-H-116[4] FF-H-121[5]	average minus tolerance of 10%

Publications under following footnotes are obtainable of the Superintendent of Documents, Washington, D. C., at the prices stated. (Stamps not accepted).

[1]WW-P-541. Plumbing Fixtures. 10c.

[2]FF-H-106. Locks and lock trim. 5c.

[3]FF-H-111. Shelf and miscellaneous. 10c.

[4]FF-H-116. Hinges. 5c.

[5]FF-H-121. Door closers. 5c.

[6]When such thicknesses as 0.00009 and 0.00018 inch are specified, no tolerance is permitted, as these values have been obtained by deducting 10 per cent from the nominal thicknesses formerly specified.

The results show that 15 out of 28 specimens, or 54 per cent, passed the specifications. Considerable variation was found. This variation of thickness on (supposedly) similar specimens indicates that greater efforts must be made to obtain uniform distribution of coating on different pieces plated at one time. It so happens that the Preece test is readily applicable to factory control.

III. CONCLUSIONS

The results compiled in this paper could naturally be considered more representative of commercial electroplating if we knew better the sources of the shipments and were certain that all parties concerned were familiar with the specifications which would be applied. Thus, as much of the material was submitted through contractors and jobbers, it is reasonable to suppose that some manufacturers and platers did not know what was expected.

The results do show, however, the condition of the market as we found it. They prove that plated commodities of a specified quality can be produced, but that to obtain them it is essential for the purchaser to undertake systematic sampling and testing of shipments for compliance. Individual weaknesses have been pointed out. It is hoped that in the near future all large consumers will appreciate the value of purchasing plated goods under suitable specifications. When such specifications are uniform and widely used, the general public will benefit from a higher quality of plating. In addition to the thickness specifications now in use, it is very likely that others on porosity, adherence, etc., will be developed soon.

The most obvious lessons for the electroplater are to be constantly on the alert for any special requirements of a consignment, to strive for an adequate factor of safety in plating each kind of goods, and to obtain still closer cooperation in the control of the plating processes. Working with these objects always in view, it is very probable that these or any other reasonable specifications could be satisfactorily met. (Applause)

CHAIRMAN THOMPSON: Are there any questions that you care to ask of Dr. Blum before the formal discussion?

MR. DAVID GREENBLATT (Garden City Plating & Mfg. Co., Chicago, Ill.): It just happens that we have received an order based on that formula for nickel silver that you have on the

board. They want chrome plating directly on the German silver, with no nickel on the top, with a bright finish and a deposit of .002" chrome. How can we do it?

The minute it gets into the bath it becomes etched. We are not to get any nickel on it at all. I do not know how to do it. We had better success on the brass than on the German silver.

DR. BLUM: Let me explain that on that first requirement of the .0001" chrome nickel underneath is now permitted but not required. If you feel that you can put on .0001" of chromium better over nickel, there is no objection to it—providing you have .0001" of chromium there. We do not test for the nickel so long as it is not included in the specification.

I will call attention, however, to the fact that we did not include an analysis by manufacturers in this report because there were too many specimens where we did not know the name of the manufacturer. They simply came through jobbers and plumbing supply houses that might furnish some of this and some of something else, so we omitted any comparison by manufacturers, but I can say that certain manufacturers not only put on .0001" of chromium, but their products regularly run between .0002" and .0003", and they have a perfectly bright finish.

I do not know whether they buff those goods or not, but the fact remains that they often have a good finish with oftentimes twice as much chromium as specified.

MR. JOSEPH A. MCCONAS (Scovill Mfg. Co., Waterbury, Conn.): Under the heading of "plumbing fixtures, brass" I presume that specification holds good for wrought material and cast material?

DR. BLUM: Yes.

MR. MCCONAS: Is there any distinction in the specifications?

DR. BLUM: There is no distinction in the specifications for plating.

MR. MCCONAS: I presume you have good reasons for having the specifications on the brass hardware, .0002" nickel for plumbing and .0001" nickel for hardware. I am inclined to believe they should be the other way around. Plumbing fixtures are exposed and they are touched; the hardware is probably butts, hinges, and latches, where they will be handled and exposed to the weather.

DR. BLUM: I personally feel that the specifications for hardware and plumbing fixtures should be identical, but this in-

volves one of those slow processes of being able to get an agreement in an industry with a committee, to be able to get them to see that, and I do not wish to be too hard on the hardware manufacturers when I say that with a more lenient specification they had more failures. With only half the requirement that the plumbing manufacturers were meeting there were more failures on hardware than there were on plumbing fixtures.

CHAIRMAN THOMPSON: We will now hear from Mr. William M. Phillips, of the General Motors Company, who will give us the formal discussion of the paper that has been presented.

MR. PHILLIPS: Gentlemen: I do not know just what the term "formal" or "informal" would mean in a discussion of this kind, but the matter of specification, I think, is the principal aim of this work. As Dr. Blum says, the thing we are trying to do is to put this vast amount of information to some practical use

First of all, I might remark that there are two kinds of specifications. There is one that is written in the hope that you will get it filled, and another one that you expect to have filled. There have been both kinds written and used.

I think the type of specification you hope to have filled does some good if you can keep people working at it and trying to meet it.

Now, some of these federal specifications have evidently been written in the hope that they will be filled, because the percentages are pretty small. Of course they probably rejected the stuff and it was shipped to somebody else, but what we want now, I believe, is a specification that comprises a satisfactory requirement on the basis of the knowledge we have gained from these tests

As Chairman of this Joint Specifications Committee, I found there was quite a lot of disagreement as to just what those specifications shall be. There is also quite a lot of agreement, fortunately. I think, if we approach this in the spirit of giving and taking a little bit, that we can arrive at a pretty satisfactory conclusion.

I might say that in the matter of agreement the thickness of the plate on steel, copper, and nickel, at least is pretty fairly in agreement. There is just one point there on which there is probably a little bit of disagreement, and that is whether these specifications shall be stated with a minimum requirement or not.

The specification that I am most familiar with has worked on a minimum requirement. That generally makes a pretty stiff specification, particularly if you require a minimum of about .001". Possibly .001" is a little in advance of the ability and equipment of some manufacturers

As has been stated by Dr. Blum, these various panels that were put through had fairly uniform coats. They were not entirely uniform, but they were fairly uniform, so that the thicknesses stated there are approximately the thicknesses we are talking about all over, and, whereas, in a sense they are average, they are more particularly stating minimums.

Recently there was a meeting in Detroit of some manufacturers, and to my surprise they felt that if we stated .001" average on the copper and nickel over steel .75 of that should be the minimum plate or .00075". Well that is a pretty good specification, and if it can be met (and I believe it can) we will not see very many rusty parts on the road.

Now, a matter of quite some disagreement after you have found out how thick a plate shall be is how you are going to find out whether the plate is continuous or not. What are you going to do about the pores in the plate? The ferroxyl test as a means of finding pores is highly sensitive; it picks out pores in almost anything you do. And the salt spray test is simply another one of those in this particular application, and I am referring to copper, nickel, or chromium over steel. If you have a 24-hour specification and your eyesight is pretty good and you are feeling mean, you can reject a lot of stuff because you can find holes in it. If you let it run for forty-eight hours the rust spots get bigger and you do not even need to have had a night out. You can reject a lot of stuff right away; so that I think, after all, the idea of this salt spray is a means of finding the pores, and if you run it a long time and put the long salt spray on the specification then it is going to be very easy to find the porous places.

We have got to have something, I believe, of that kind in the specifications, and at the meeting down in Washington there was an agreement that something ought to be in there, but just exactly what was not fully agreed upon, and I find that the representatives of the motor industry feel that a salt spray, possibly of twenty-four hours, should be applied in such a way that there are no porous spots at all accepted. At least, they have the right to reject if they find those.

Incidentally, there has just been a meeting of the Master Electro-Platers Institute here in this same hotel, and they are working up the code requirements on jobbing electro-plating, and they have got to have some sort of specifications in order to put teeth into their business; that is, if somebody is going to come out with a plate half as thick to compete with somebody else who is doing a real job, it will not be very nice competition; so they expect to have a specification, and I think it is a rather good idea. In fact, Mr. Wise, who is present here, has recently been elected head of their Standards Committee. It would be a very good idea to consider that group as with us in writing these specifications.

I may also say that the A.S.T.M., who have worked wonderfully with us in this matter, have certain committees through which the specification has to pass. I believe it is up to us to get this matter drafted in a satisfactory way and as quickly as possible get it through their committee, in the meantime consulting with this Master Electro-Platers Institute to get the specification out and working. The sooner we do that, the better off we are going to be.

This is not a matter that delay is going to improve. The specification can be changed. If, later on, we find some different information that may possibly make changes, it is very easy to change the specification, but I believe a specification should result just as promptly as possible.

We have spent some money; we have spent a lot of effort. Dr. Blum and Mr. Strausser and others have done a beautiful piece of work here on which we should cash in. It ought to be paying dividends, and this is about the only way we can do it — by getting this specification out.

I am going to attempt to call a meeting at this session of the members of this committee of the American Electro-Platers' Society, to see what the ideas are there. I, unfortunately, have a letter here which did not please me at all, from the Chairman of the Sub-Committee 7 of the A.S.T.M., in which he states that there will be no meeting of Sub-Committee 60 scheduled at the annual meeting of the A.S.T.M. "This decision has been reached because of heavy schedule of meetings now proposed for the annual meeting, and the desire expressed by the Society's officers that only such meetings as are absolutely necessary be held at this time, in order to permit as full attendance as possible at the

various technical sessions." I do not know whether it is going to be possible to over-ride that.

DR. BLUM: I do not know. I think we could probably do a good deal more by correspondence.

MR. PHILLIPS: At all events I think we will get together on this thing, officially or otherwise, and try to promote this specification. Each and every man here can help out on this. When we get these specifications done it is going to be a little bit harder for all of us at first, and that certainly includes me to a considerable extent. If we start meeting these specifications there are going to be a lot of headaches, but when we get it done it is going to promote the whole art of electro-plating very satisfactorily.

I think some of those figures that Dr. Blum read are the most encouraging things I have heard for a long while. If the plumbing trade can get up to 100% then all of us can get up to 100%, and then when we do that we will look for stiffer specifications so that we will be sure of a job the next morning.

I think that this thing is really coming along in very, very excellent shape. I do not know whether I should say anything more about the details of these specifications or not. The idea generally expressed is for a Class A specification, and we want about .001" average plate with the idea that a minimum will be stated later on, that we will have a salt spray determination, and Dr. Blum would like (and I would, too) to have some means of determining thickness. I have looked up, at his request, quite a few methods, and everybody is willing to contribute those methods. We will have to pick out one that seems to fill the bill in the best possible shape.

I think that is all I have to say in this formal or informal discussion at this time. As soon as the committee has met we will have a further report to make which we will make publicly in some way or other.

TENTATIVE SCHEDULE OF EXPOSURE TESTS OF ELECTROPLATED STEEL

Revised August 1, 1934

THE following schedule is tentative and subject to change. Any interested persons may be present at these inspections, with the understanding that they will not use any information obtained at that time for publication or for advertising purposes.

Visitors expecting to be present are requested to notify W. Blum or the person designated for each location, so that they may learn the exact time of the inspections.

Members of the Joint Inspection Committee, or persons whom they may designate as their substitutes, are requested to advise the representative for each location whether they will be present, so that arrangements may be made to insure a few members at each inspection.

Please note that in the inspections, disregard (a) any rust within $\frac{1}{4}''$ of edges of buffed samples, and (b) any rust stains that are more than $\frac{1}{4}''$ from the apparent source of the rust.

Please note that at State College and Washington, the inspection reports will be made on *yellow* folders; while in the other four locations the *blue* folders must be used.

I. Key West, Florida

Notify W. Blum, Bureau of Standards
Wednesdays, Sept. 12, December 5, February 13.

II. Washington, D. C.

Notify W. Blum, Bureau of Standards
10:00 A.M. on Wednesdays, Sept. 12, December 5, March 13.

III. Sandy Hook, N. J.

Notify C. L. Hippensteel, 463 West Street, New York City.
10:30 A.M. on Fridays. August 10, November 16, February 15.

IV. Bell Telephone Laboratories

Notify C. L. Hippensteel, 463 West Street, New York City.
1:30 P.M. on Thursdays. August 9, November 15, February 14

V. Brunot Island, Pittsburgh, Pa.

Notify Herman Peter, 1220 Ridge Ave., N. S., Pittsburgh, Pa.
1:30 P.M. on Saturdays. September 15, December 15, March 16.

VI. Penn State College, State College, Pa.

Notify Dr. G. C. Chandlee, State College, Pa.
9:00 A.M. on Saturdays. September 22, December 8, March 9.

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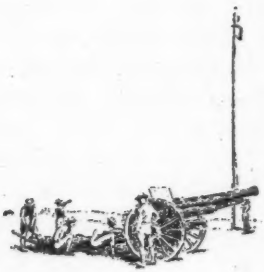

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SOLVENT DEGREASING

Read by M. Marean
of E. I. Dupont de Nemours & Co. at the Detroit Convention, 1934

THE introduction and rapid acceptance by the public of chromium plated finishes created a large demand for economical methods of obtaining permanent coatings of this metal. The comparatively unsatisfactory results obtained theretofore with polished deposits were made even more apparent when attempts were made to deposit chromium over nickel. These difficulties in obtaining good adhesion led to extensive and organized research into the factors affecting the adhesion of electrodeposited films onto base metals.

These studies showed clearly that this adhesion was due not only to the characteristics of the plating bath, but largely to the preparation of the base metal surface prior to its introduction into the first plating solution. Furthermore, micro examination of the surfaces to be plated brought out the fact that this preparation involved two distinct but equally important processes:

First, the complete removal of all traces of grease, not only from the surface of the metal but also from the minute pores and crevices in this surface. This problem is further complicated by the fact that the expansion, due to heat during the polishing operation, enlarges these pores. Subsequent contraction on cooling tends to trap grease, oil, and polishing compounds in these openings and to make their complete removal difficult.

Second, the alteration of the crystal structure of the metal surface to permit the deposit to obtain a mechanical key in the pores of the base surface.

It is not within the scope of this article to discuss the advantages and disadvantages of the many methods available to obtain this alteration of the metal surface structure. Among the most common methods used may be mentioned electrolytic alkali or acid, bright dip and cyanide baths. However, regardless of the method used, the results obtained and the cost thereof are largely dependent on the thoroughness with which the grease is removed prior to subjecting the metal surface to this treatment. In the complete absence of all traces of grease the desired results can be readily and economically accomplished.

The removal of grease, therefore, was studied to evolve a process fitted to modern plating practice. For a long time the accepted method of grease removal was by means of aqueous solutions

of alkaline materials, together with hand brushing and/or electrolysis. Since most of the industrial oils and greases are insoluble in water, the detergent action of these aqueous solutions is the result of a partial saponification, of animal and vegetable greases' and emulsification of the mineral base oils. Both of these reactions are comparatively slow and the time required varies considerably for different types of oil or grease. Both hand brushing and the violent mechanical agitation produced by the hydrogen evolved in electrolytic cleaners, assist greatly in accelerating both of these detergent actions. However, it should be remembered that the emulsions thus formed are very unstable. The grease and oil therefore tend to form a scum on the surface of the cleaning bath, which, if not completely removed, will contaminate the cleaned surfaces with traces of grease when the articles are withdrawn from the cleaning solution through this scum. Furthermore, it is extremely difficult to clean by this method articles which are deeply recessed, of an irregular shape, or with inaccessible or partially masked surfaces. These obvious disadvantages and shortcomings indicated that the improved method should embrace the principle of removing the oils or greases by dissolving them rather than by saponifying or emulsifying them.

There were many known solvents for the industrial oils and greases. Of these, probably the most obvious were the lower boiling hydrocarbons such as gasoline, kerosene, naphtha and the like. The use of these, however, presented several undesirable features, among which were:

1. The inherent fire and explosion hazard due to the inflammable nature of these compounds.
2. The necessity of using them cold due to their volatile nature.
3. The necessity of using several rinses due to the fact that the solvent rapidly became contaminated with oil, which was left on the surface of the articles when the solvent evaporated.
4. The difficulty of reclaiming the solvent from the oil-solvent mixture.
5. The necessity of hand-wiping the articles to remove solids not removed by the solvent.

The method of grease removal using this type of solvent, although widely used for many cleaning problems, has not had

widespread application in such critical operations as electroplating.

Another group of solvents were the chlorinated hydrocarbons, such as carbon tetrachloride, trichlorethylene, perchlorethylene, etc. The use of this type of compound, because of the comparatively high initial cost of the solvent, required the development of special equipment and technique. It soon became apparent that to obtain satisfactory results the solvents should be used at or near their boiling points. This required that the solvent possess the following characteristics:

1. Non-flammability, since the use of flammable solvents would introduce an extremely dangerous fire and explosion hazard.
2. A boiling point lying between 150° and 250° F., since below this minimum the volatility of the solvent would make control of the vapor impractical, while above the maximum it would be difficult and expensive to maintain the temperature.
3. Thermal stability, since any decomposition under the influence of heat would produce hydrochloric or muriatic acid. This would corrode the articles being cleaned, the equipment and the metal structures in the vicinity of the cleaning apparatus.
4. Chemical stability, since decomposition in the presence of water or other agents would also produce hydrochloric acid with its attendant corrosion.

Only a few of the chlorinated hydrocarbons possess these characteristics to a sufficient degree to permit their use on a commercial scale. However, because of the many advantages of the cleaning method employing these, this method of grease removal which we term solvent degreasing has received rapid and widespread application, not only in plating shops but wherever critical operations require a grease-free surface. In addition, the cost of the process is such that it has been widely adopted on much more crude operations, such as machine maintenance and manufacture.

In modern solvent degreasing practice, the solvent is used not only in the liquid form, but also in the vapor phase. The use of the vapor phase introduces an entirely new principle into the grease removal field. In effect the cold metal, when immersed in the solvent vapors, recondenses them to the liquid phase over

the entire surface of the article to be cleaned, irrespective of its shape. The grease and solvent solution thus formed run off the objects to the sump of the machine. The grease, oil, and other dirt are thus deposited out of reach of succeeding batches of work because the pure solvent is re-vaporized from the dirty sump mixture, while the greases remain behind due to their much higher boiling point. Solvent degreasing is, therefore, readily adaptable to any particular problem, regardless of the nature, shape or size of the article to be cleaned, or the nature of the grease present. It should be appreciated that this is the only known method of grease removal which allows repeated and continuous use of the cleaning fluid and at the same time permits every batch of work to be cleaned by washing of clean solvent. In all other methods the washing medium is necessarily contaminated by the grease from previous loads.

When solvent degreasing is used, the primary cleaning action is due to the high solvent capacity of the hot solvent for all types of grease. Since the articles become heated through contact with the solvent or its vapors, the pores in the metal surface are expanded sufficiently to permit easy removal by the solvent of the grease trapped therein. In addition, the heat reduces the viscosity of the grease, thereby aiding its solution. The temperatures used are not, however, sufficiently high to affect the temper of the metal nor to alter its crystal structure.

Due to the low surface tension of the solvent, in either the liquid or vapor phase, it will penetrate and remove the grease even from deep recesses, holes, inaccessible or partially masked surfaces, provided the article is so placed in the bath that air pockets are not formed and the solvent can drain freely from all surfaces.

Where loosely adhering solids, such as shop dirt, metal chips, filings, turnings, or millings, and especially polishing compounds are present, the primary cleaning action mentioned above is sometimes supplemented by a secondary action of mechanical washing. This washing action can be obtained by several means such as agitation or tumbling of the articles in the solvent; agitation of the solvent, or spraying of the solvent under pressure onto the articles. This action is, however, necessary only when, in addition to an absolutely grease-free condition, a clean metal surface is required, as is the case with plating processes.

The low cost of this cleaning method, in spite of the comparatively high cost of the solvent, is due largely to two factors:

1. The metal, if left in contact with the boiling solvent or its vapors for a sufficient length of time, is heated to the boiling point of the solvent. The thin film of adhering liquid therefore vaporizes immediately, upon withdrawal of the articles from the cleaning bath into a saturated and controlled vapor column and is therefore not lost. The drag out losses are therefore comparatively low.
2. The solvent is readily and economically recovered from the oil-dirt-solvent mixture, and can therefore be used repeatedly.

As regards the first of these factors, it should be pointed out that the minimum solvent losses are almost directly proportional to the area of solvent in contact with air and to the area of the metal surface which is subjected to the action of the solvent. Both of these areas should be kept at a minimum, the first by proper design of the greasing equipment, the second by so designing the baskets, racks or other means used to introduce the articles into the degreaser, that they present the smallest possible area of metal consistent with the strength and rigidity required.

Furthermore, it is obvious that if the shape of the article is such that liquid solvent can be trapped in cups, recesses or indentations, the drag out losses will be greatly increased. It is therefore essential for economic operation that articles be placed in the cleaning bath in such a position that the solvent can drain easily from all surfaces and that they remain in contact with the boiling solvent or its vapors for sufficient time to become heated to the boiling point of the solvent. For the plating industry this time is seldom longer than one minute per batch of work.

By the large scale adoption throughout the industry, this process has proven to be the most economic cleaning method available, providing the above-mentioned conditions are satisfied, and providing, furthermore, that the equipment used in any specific problem is of the proper type, size and design.

The decision as to type and design of the cleaning equipment is the only phase which demands expert attention, and therefore remains the province of the equipment manufacturers. The operation of the machines is such that satisfactory results are obtained with the labor at present employed for cleaning.

In conclusion, the major advantages of this method of cleaning can be summarized as follows:

1. Lower overall cleaning costs due to savings in power, heat, labor, and material for subsequent operations.
2. Uniformity of results, since all oils, greases and waxes are dissolved with equal rapidity.
3. Rapidity of operation, permitting large outputs from comparatively small equipment.
4. Elimination of the human element, thereby reducing rejects due to improper cleaning
5. Ability to clean all metals without attacking or damaging polished surfaces or delicate objects.
6. Ability of the process to clean work already racked or wired for plating, thus eliminating handling the cleaned articles. (Applause)

Mr. Barron, the co-author of this paper, is here, and he has had five or six years of experience with degreasing, not only in this country but in England, and he will be glad to answer any questions on this paper that you may have.

DR. MITCHELL: I would like to ask if you have any figures as to the approximate cost per unit area of metal, say 100 square feet, or 1,000. We have similar figures for other methods of cleaning.

MR. MAREAN: Yes. The matter of area has been occupying our attention very much more of late for this country than for England. Everybody over here is demanding area, and we find that it is in the order of approximately 1,600 square feet per gallon.

DR. MITCHELL: The Imperial Chemical Industries, in their literature, state that they use between three and three and a fraction gallons of solvent per thousand pounds of material.

MR. BARRON: We are finding, from an examination of 300 of the plating shops, that the average plater wants weight over there, and they want area over here. It works out approximately two imperial gallons to approximately 1,100 pounds. Those are average figures, taken from about 300 shops.

Dr. MITCHELL: And what was your translation into area?

MR. BARRON: The area figures are, I say, somewhat misleading. We have been endeavoring to get them for such things as fenders, bumper bars, and the larger objects, and the very difficult condition to giving an area is that the average plating man wants

to come right down to screws. The jobbing plater wants to get down to small articles and anything thrown at him, and the manufacturer wants to know it for some specific articles. We have them as high as 5,000 on things like fenders, and the average figures, apparently, for a job plater are about 1,600 square feet for the loss of an imperial gallon.

MR. HOGABOOM: I would like to ask whether you can get your metal in this process free from water breaks, so that you get a good bond between the base metal and the deposit?

MR. BARRON: That has been one of our most difficult points in getting over with the plater who, for his whole life, has adopted a water break test as his standard, and it is somewhat difficult to explain to him that this is the first time he has ever seen an object made one hundred per cent grease free and at the same time absolutely dry.

It is an easy and convincing demonstration to take a bath of comparatively hard water, take two identical articles, degrease them by the identical method, and put one of them into the hard water. It immediately shows a water break all over it. The old plater says immediately, "It has grease on it." If you add about two drops of some water softening agent to a comparatively large volume of the hard water it will hold the water break all over, indicating that the particles of the metal, and possibly microscopic bloom, or very, very fine metallic powder on the surface of the metal, are so dry that it is like putting water on a dusty floor. It runs. But is you lower the surface tension of the water, it holds all over.

Another very convincing test that the article is grease free is that you can take it and, by putting it into a copper cyanide bath (which obviously wets all over), you can plate all over it.

MR. HOGABOOM: How about the adhesion? Have you any figures on adhesion?

MR. BARRON: I do not know what figures I could give. I have none. All I can say is that the average plating man claims lower rejects from stripping after adopting degreasing, which indicates that the adhesion is as good if not better.

MR. HOGABOOM: It evidently appears that previous to this discovery you had a lot of trouble with failures; still, there are a lot of platers who are not using the process whose rejections are less than one-half of one per cent.

MR. BARRON: I do not think even you will suggest that

plating has not improved of late years; or, shall we say, that adhesion has not improved, because if you do not accept that, why did the plating industry have to go so very deeply into the question of adhesion when chrome plating came along and lifted your nickel off for you?

DELEGATE HANLON: Have you any data on the stability of the solvent?

MR. BARRON: These solvents, up to about four or five years ago, gave for themselves a very unenviable reputation. To begin with, they were not free of other components during fractional distillation. It was fairly quickly realized that small quantities of other compounds present gave extreme instability, and about five or six years ago it was found out that by eliminating the other compounds the boiling range was brought down from five or six degrees Centigrade to within half a degree Centigrade, and it is now getting even closer than that.

Then it was still found that there were two forms of decomposition, one photo-chemical, the other thermal. Against thermal decomposition there is no complete inhibitor; against photo-chemical there is, and that is now attended to in solvents which are specifically used for metal degreasing. They are totally different, say, from one used for dry cleaning. The addition of inhibitors has quite killed that business of instability due to light and heat.

MR. GREENBLATT: What effect has it on a worker who works with it? Is it dangerous to work with it?

MR. BARRON: Most of the solvents that are discussed are toxic, as is every other solvent that I know. In consequence the range of solvents used for metal degreasing has been limited to a maximum of three, anyway, with one very definitely the best. That particular solvent is being used the most widely for metal degreasing. It is being used by the medical profession for washing wounds before they dress them on workmen's hands. In England they have about 2,000 machines which are installed, many of them being operated by female labor. There are no regulations by government authorities. who watch this extremely carefully on behalf of the workers. In Germany they have a thousand or more machines, and they have no regulations there.

I think we have to balance on this question of harm to the workers the fact that there are something like 5,000 machines

being worked by all classes of labor, and on metal degreasing I do not know that there has been any serious accident or claim for an accident.

CHAIRMAN BLUM: Which solvent did you say was the most used?

MR. BARRON: Inhibited trichlorethylene.

MR. JERRY DE GRAZIA (McGill Manufacturing Co., Valparaiso, Indiana): Do I understand that you can take steel stampings off a punch press, filled with grease, and go through this degreasing apparatus and then rinse in water and put them into the plating solution without any peeling?

MR. BARRON: That will largely depend upon the surface. It is essentially a degreaser, and not the millenium. I will put it akin to the vitreous enamel trade, where it is very widely used as being the quickest degreaser before their pickler, and I would suggest that a pickler be used.

MR. DE GRAZIA: If this stuff has no scale—

MR. BARRON: In this case he has put up the question of an article which is oxide free, and you can take articles from a degreaser into a cadmium bath and plate them perfectly, with perfect adhesion.

On that question, I think there is at least one gentleman here who is putting through quite a quantity of work for cadmium plating by degreasing and putting it straight into the bath.

DELEGATE COLE: Do you find, after degreasing, that you have any film left on the product? For instance, we have a die cast tank in which we degrease, and it seems to me that there may be some sort of film that we are not removing with an alkaline cleaner.

MR. BARRON: I think this question of film boils down to the question that we endeavor to cover by the word "bloom", which is something that we tried to analyze microscopically, and it represents the percentage of the finest powders from polishing, the atmosphere, loosened particles from stamping, rolling or whatever the fabrication process was, plus, in many cases, a condition of people using solvents which are not inhibited, and the slight acidity plus a porous surface in the form of these particles of dust is holding that very microscopic amount of acid in contact with a surface that, when it went into the bath, was probably moist as a result of condensation from the atmosphere.

Your moisture on your metal dissolves your H Cl gas and holds it there, and I think the answer to it is that the application should be a liquid one, where the particles will be washed away and, second, the solvent used should definitely be inhibited, and I think you will overcome that.

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The Abstract Section

EDWARD B. SANIGAR

THESE abstracts are mostly adapted, by permission, from "Chemical Abstracts", the references to that publication being given in the form — *C. A.*, **27**, 3402 (1933) *i. e.*, Chemical Abstracts, Volume 27, column 3402 in the year 1933. The name appearing at the end of the abstract is that of the abstractor. Abbreviations for scientific journals are those used by "Chemical Abstracts" (see *C. A.*, **25**, 6019 (1931). E. B. S.

Electrolytic deposition of nickel from baths of a pH greater than 7. M. BALLAY. *Compt. rend.* **198**,1494 (1934). cf. *C. A.* **27**,2626 (1933).—The precipitation of nickel hydroxide or basic salts from solutions of pH 7-9 can be prevented by the addition of a large quantity of ammonium sulfate; but in such cases the slight solubility of nickel ammonium sulfate presents a difficulty. Glycolic or lactic acid (150g./1.) prevents precipitation by ammonia in a solution containing 20.8g./1. of nickel (as nickel sulfate), and citric acid acts still more effectively, precipitation being prevented by adding sodium citrate to a solution containing 20.8 or 45g. of nickel per liter so that the ratio (atomic concentration of nickel): (molecular concentration of citrate) = 2:1, the ratio diminishing with lower concentration of nickel. With a solution containing 20.8g. nickel per liter, 6g. ammonia, 6g. chloride radical and 150g. crystalline sodium citrate at 40°C. and current density 2-10 amp./sq.dm. (18.5-93 amp./sq. ft.), satisfactory results were obtained with a pH 3.6-9.8, the cathode current efficiency being 59.2, 90, and 94% for pH 5.7 and 9.6, the anodic current efficiency 100, 100 and 88%, respectively. Malic and tartaric acids and glucose, maltose and glycerol are without action; addition of di-sodium tartrate results in the formation of a jelly insoluble in aqueous ammonia. *C. A.* **28**, 3986 (1934).

Deposition of nickel. French patent No. 760,810. March 3, 1934. FALCONBRIDGE NIKKELVERK AKTIESELSKAP.—In depositing nickel electrolytically from nickel salt solutions, the plates on which the nickel is to be deposited are subjected to the action of a dilute acid having a concentration and temperature such that a cleaning is obtained without attacking the surface. The plates are introduced into the bath without washing and while damp. *C. A.* **28**, 3989 (1934).

Nickel anodes. French patent No. 760,809. March 3, 1934. FALCONBRIDGE NIKKELVERK AKTIESELSKAP.—Nickel plates obtained by electrolysis are prepared for use as anodes and for other uses, by heating the plates in a fused saline mass, e.g., a mixture of potassium and sodium chlorides at 800°C., then heating the plates to redness and plunging them into a tempering liquid. *C. A.* **28**, 3990 (1934).

Electrolytic chromium plating. N. P. LAPIN and L. N. HOLTZ. Trans. State Inst. Applied Chem. No. **17**,121pp. (1933).—A review of the

theory and practice of chromium plating with 149 literature references and long list of patents. *C. A.* **28,** 3986 (1934). S. L. MADORSKY.

Electrodeposition of chromium. German patent No. 595,159. April 3, 1934. MAX SCHLÖTTER.—An anode of chromium and an electrolyte of chromium salt solution are used, and electrolysis is effected with direct current on which alternating current is superimposed. Details are given. *C. A.* **28,** 3989 (1934).

The Electrodeposition of zinc. I. Y. OGAWA. *J. Mining Inst. Japan* **48,**1289 (1932); *Met, Abstracts* (in *Metals & Alloys*) **5,**49.—Ogawa began with electrolysis of pure solutions, with platinum anodes in order to get rid of the effect of lead which is usually neglected. Influence of the rise in temperature was studied as well as effects of the variations in the composition of the electrolyte, current density and speed of agitation. Current efficiency was found to increase with rise in temperature (between 30°C. and 80°C.) for current densities of 3 and 12 amp./sq.dm. (28 and 111.5 amp./sq.ft.). Where the impurities are absent, the cause of the lowering of the current efficiency should be sought in the simultaneous discharge of hydrogen-ions with zinc, but not in the so-called chemical corrosion of the zinc already deposited. The phenoma observed were explained from this standpoint. *C. A.* **28,** 4317 (1934). G.G.

Electrodeposition of materials such as copper sheets or foil. U. S. patent No. 1,960,563. May 29, 1934. R. A. WILKINS (to Industrial Development Corp.).—To facilitate stripping of material such as copper from a cathode such as a rotating cylinder, the cathode surface is wetted, prior to the deposition, with a film of selenious acid dissolved in a substance such as ethyl alcohol or glacial acetic acid having a low surface tension as compared to water with respect to the material of the cathode, which may be formed of copper or silver. Apparatus is described. *C. A.* **28,** 4320 (1934).

Electrodeposition of magnetic alloys of nickel, iron and cobalt. U. S. patent No. 1,960,029. May 22, 1934. A. G. RUSSELL (to Bell Telephone Laboratories, Inc.).—An electrolytic bath contains sulfates of each of the metals and magnesium sulfate, mixed in proportions depending upon the proportions of the metals desired in the alloy, and a direct current is passed through the composite electrolytic bath to deposit the desired alloy substantially free from other materials. Apparatus is described. (Compare Monthly Rev. **20,** No. 4.38 (Dec. 1933). E.B.S.). *C. A.* **28,** 4321 (1934).

Cobalt plating. French patent No. 761,517. March 21, 1934. Soc. d'utilisation des métaux.—A bath for galvanic cobalt plating on metals contains cobalt chloride ($CoCl_2$) mixed with an alkali bifluoride, and preferably, but not necessarily, a certain amount of boric acid. *C. A.* **28,** 3989 (1934).

Aluminum surfaces. French patent No. 761,876. March 29, 1934. Aluminum Colors, Inc.—The surface of aluminum or its alloys is coated with a film of oxide by an electrolytic treatment using an electrolyte containing sulfuric acid and an organic acid, e.g., oxalic, malic, malonic, maleic and succinic acid, or using two electrolytes, one containing sulfuric acid and the other an organic acid. *C. A.* **28,** 3990 (1934).

Protecting aluminum, zinc, magnesium and their alloys from corrosion. U. S. patent No. 1,923,502. August 22, 1933. P. PRIER.—These metals are provided with a protecting layer by the action of a bath containing in aqueous solution about 1.5% of both a phospho-chromate of an alkali metal and a sulpho-molybate of an alkali metal, about 0.5% of an ortho-phosphate of an alkali metal, and about 1.5% of an alkali salt of an organic oxy-acid such as sodium tartrate. (See following abstract. E.B.S.).

C. A. **27,** 5047 (1933).

Protecting light metals against corrosion. U. S. patent No. 1,957,354. May 1, 1934. P. PRIER.—Light metals, such as aluminum or magnesium or their alloys, are protected from oxidation by immersing them in a solution such as may be formed of potassium and titanium double fluoride 2, chromium fluoride 1, sodium fluoride 0.5 and water 1000 parts. (See previous abstract. E.B.S.). *C. A.* **28,** 4032 (1934).

Analytical control of cadmium electroplating solutions. E. E. HALLS. *Metallurgia* **9,**183.—Complete directions are given for analysing for cadmium, free cyanide and alkalinity.

C. A. **28,** 4002 (1934). J. L. GREGG.

Testing of copper-plating baths. T. HAMBURGER. *Ztg. deut. Buchdrucker* **44,**523 (1932). *Met. Abstracts* (in *Metals & Alloys*) **5,**49.—After dilution of the liquid sample, sulfuric acid can be directly determined by titrating with sodium hydroxide. The copper sulfate content is found by determining the density and substracting the density corresponding to the sulfuric acid content (table). A contraction factor of 1.0015 is also subtracted. *C. A.* **28,** 4318 (1934). G.G.

The cleaning of iron and steel. S. WERNICK. *J. Electroplaters' and Depositors' Tech. Soc.* **7,**163 (1932).—The necessity for the efficient cleaning of iron and steel, since the plating on such parts is applied primarily to prevent their corrosion, is stressed. Alkaline, electro- and acid cleaning are discussed from the viewpoints of composition, function of constituents and conditions of use. (See following abstract. E.B.S.).

C. A. **27,** 668 (1933). E.B.S.

Cleaning of metals. III. Theory of the alkaline cleaner. S. WERNICK. *Ind. Chemist* **9,**275 (1933).—For the removal of fat, this must be emulsified for some time. The addition of soap (2%) to water reduces the surface tension; alkali (2%) does not. The addition of alkali to soap solution reduces the interfacial tension against oil, but the surface tension is increased. Low interfacial tension promotes the formation of an emulsion, but there is an optimum pH for its permanence. The relative detergent values of soaps differ for different types of (solid) "dirt". For each soap solution there is an optimum detergent concentration within the range 0.2-0.4%. Rise in temperature of the detergent results in a reduction of the detergent value. The relative detergent values of sodium hydroxide, sodium carbonate, tri-sodium phosphate and sodium silicate ($Na_20.4Si0_2$) are given. IV. **Some practical aspects of alkaline cleaning.** *Ibid.* 308.—Trichlorethylene and carbon tetrachloride are used for the removal of grease. Aqueous sodium hydroxide, sodium carbonate, sodium silicate, trisodium phosphate, potassium hydroxide, potassium carbonate, with or without the addition of an insoluble substance, e.g., china clay, aluminum hydroxide,

are also used with or without previous degreasing treatment. Zinc may be cleaned by aqueous sodium zincate and sodium silicate, and aluminum by aqueous sodium aluminate and sodium silicate; copper, brass and nickel-silver are cleaned by aqueous potassium cyanide (1-2% solution). (See previous abstract. E.B.S.). *C. A.* **28,** 4348 (1934). B.C.A.

The stability of trichloroethylene and its corrosiveness with metals. Anon. *Chem. Trade. J.* **93,**227 (1933); *Rev. gen. mat. color* **38,**25 (1934).—Of some 16 stabilisers studied, dibutylamine is most effective, with inhibition factor of 220, down to benzine with 1. On a test razor blade, of these stabilisers only the alkylamines, benzylamines and diphenylguanidine do not attack the metal. For ferrous metals, alkylamine stabilisation is particularly advantageous. With 0.07% alkylamine for practical cleaning purposes, soft steel, cast iron and zinc are only slightly attacked.

C. A. **28,** 4026 (1934). H. E. SILLIMAN.

Pickling of iron and steel. H. G. HOBBS. *Iron Age* **133,** No. 18, 19, 72 (1934).—The early history of pickling and of the development of inhibitors is briefly reviewed. A theory of the action of an inhibitor in an acid solution is presented. Samples of scale-free carbon-steel sheet pickled 1 hour in 5% sulfuric acid at 85°C. lost 0.2275g. per sq. inch of surface. The addition of 4 ozs. of an unidentified inhibitor per 100 lb. of 60° sulfuric acid, changed the loss of weight to 0.0033g. per sq. inch. The benefits of an inhibitor are summarised. *C. A.* **28,** 4349 (1934). F. G. NORRIS.

Acid solutions for cleaning and pickling metals. U. S. patent No. 1,957,488. May 8, 1934. W. S. CALCOTT, L. S. BAKE and I. E. LEE (to E. I. du Pont de Nemours & Co.).—A compound obtained by combination of a primary or secondary amine with carbon disulfide, such as a derivative of carbon disulfide, acetaldehyde and aniline is used as an inhibitor.

C. A. **28,** 4030 (1934).

Influence of protective layers upon corrosion. W. MACHU. *Oesterr. Chem. Ztg.* **37,** 46, 64 (1934). — Previously published material, based upon investigations carried out by W. J. Müller and the author (*C. A.* **28,** 448 (1934)), is reviewed. The quantitative time-area relations previously developed are expanded into an exact mathematical method for computing "half periods", i. e., the time in which one-half of the layer area is destroyed. The use of this method for exact corrosion investigations is recommended.

C. A. **28,** 4359 (1934). L. PESSEL.

Metal coloring and metal protection by chemical processes. H. KRAUSE. *Oberflächentech.* **11,**101 (1934); see Monthly Rev. **21,** No. 1, 39 (Aug. 1934) (E.B.S.).—Treatment of surface before coloring, and coloring processes by chemical methods for iron, copper, copper alloys and light metals are reviewed. Recently the phosphate process of Coslett has found great favor for browning of iron as no rusting occurs afterward.

C. A. **28,** 4359 (1934). M. HARTENHEIM.

Ornamental foils. German patent No. 595,205. April 7, 1934. K. MEY.—A film of gold or silver is deposited electrolytically on a metal plate or strip, and then coated with a solution of cellulose acetate. When the solution has dried, the cellulose acetate film and the film of gold or silver can be detached together from the metal plate or strip. The compound film so obtained is then pressed onto the surface to be ornamented by means of a

hot stamp, whereupon the acetate film fuses and the film of gold or silver is secured to the surface. *C. A.* **28,** 3989 (1934).

The essential charateristics of sprayed metal coatings. H. REININGER. *Z. Metallkunde* **25,**286 (1933); (see Monthly Rev. **20,** No. 3, 35 (Nov. 1933). E.B.S.).—Photomicrographs are given of iron sheet sprayed with aluminum, tin, brass and zinc; of aluminum sheet sprayed with iron and tin. Methods of studying coatings and heat treatment of coatings are described. *C. A.* **28,** 4359 (1934). R. F. MEHL.

Metals such as copper in powdered form. U. S. patent No. 1,959,376. May 22, 1934. J. H. LUCAS (to Nichols Copper Co.).—Spongy metal is deposited on a cathode such as a rotating disc by electrolysing a bath such as an acid solution of copper sulfate, and the spongy metal is scraped from the cathode without passing it through the bath and is conveyed away in a non-oxidising medium. Apparatus is described. *C. A.* **28,** 4365 (1934).

Metal porcelain. C. RANCKE. *Keram. Rundschau* **42,**20 (1934).—The porcelain is electroplated with copper and then amalgamated prior to placing it in a nickel, silver or chromium bath.

C. A. **28,** 4556 (1934). P. S. ROLLER.

Gramophone records. British patent No. 405,541. February 8, 1934. N. V. Philips' Gloeilampenfabrieken.—"Home recording" on a gramophone disc is effected by using a disc of aluminum, consisting of a single layer, the disc being transformed entirely or only at its surface, after engraving with a stylus, into a chemical compound which is harder than the metal. The hardening, which is preferably superficial and is preferably effected by electrolytic oxidation, may be done by hanging the disc in a bath of oxalic acid which is electrolysed with the disc as the anode. *C. A.* **28,** 4321 (1934).

Electrolytic baths. French patent No. 760,697. February 28, 1934. H. LEISER.—The properties of electrolytic baths are improved by using anodes of large volume. They may be formed by making parallel incisions in a plate and then drawing out the plate to form a number of diamond-shaped holes. *C. A.* **28,** 3989 (1934).

Apparatus for electroplating. U. S. patent No. 1,959,799. May 22, 1934. K. T. POTTHOFF.—A chain and sprocket system serves to carry articles to be plated. *C. A.* **28,** 4320 (1934).

Electroplating apparatus suitable for chromium plating. U. S. patent No. 1,959,764. May 22, 1934. K. T. POTTHOFF.—Structural and operative details. *C. A.* **28,** 4320 (1934).

Apparatus for electroplating silver from used photographic fixing solutions. U. S. patent No. 1,959,531. May 22, 1934. K. C. D. HICKMAN and W. J. WEYERTS (to Eastman Kodak Co.).—Various structural, mechanical and operative details are described. *C. A.* **28,** 4320 (1934).

Continuous apparatus for electroplating dress fastenings. German patent No. 596,414. May 2, 1934. SOPHIE HEIDEN nèe Kohn.

C. A. **28,** 4320 (1934).

Rubber threads and bands. French patent No. 759,310. February 1, 1934. The International Latex Processes Ltd.—Threads are made by depositing rubber from an aqueous dispersion onto a surface in continuous movement and having a series of grooves in the direction of movement.

The grooves are separated by relatively sharp edges, and pressure applied to the edges separates the threads. (See following abstract. E.B.S.).

C. A. **28,** 3619 (1934).

Rubber threads. French patent No. 761,893. March 29, 1934. The International Latex Processes Ltd.—Threads are made by depositing rubber from an aqueous dispersion in a spiral groove in a cylinder, the edges between the turns being sharp so that the rubber covering them is easily broken. (See preceding abstract. E.B.S.) *C. A.* **28,** 4631 (1934).

The definition of polarisation, overvoltage and decomposition potential. W. BLUM and J. W. VINAL. *Trans. Electrochem. Soc.* **66,** 8pp. (preprint) (1934).—From a consideration of the electrolysis of water, with smooth platinum electrodes, as a typical example, the fundamental components of the cell or bath voltage are interpreted. Revised definitions are proposed and these are discussed. The following recommendations are submitted: The "equilibrium reaction potential" is preferably used to refer to the potential based on the free energy of the process. The "decomposition potential" is the minimum potential required for continuous electrolysis. The term "polarisation" includes all departures of the potential from the equilibrium potential, and is a measure of irreversibility (excluding I. R. drop) regardless of whether the produots are solid, liquid or gaseous. The term "overvoltage" preferably refers to the minimum polarisation required for any electrode process to occur at an appreciable rate under given conditions.

E.B.S.

We publish the following letter from one of our Philadelphia Branch members, which was entirely unsolicited.

Mr. Kennedy, Editor,
90 Maynard St.,
Springfield, Mass.

1945 W. Airdrie St.,
Phila., Aug. 12, 1934.

My Dear Mr. Kennedy:

I just cannot resist any longer the temptation of commending the Review. The attractive cover, the advertisements, the papers and the abstract section, all hold one's interest. I am particularly interested in the abstract section. These abstracts are time saving, due to the fact that they are abstracted in such a way, as one can decide quickly if he wants to read the original paper.

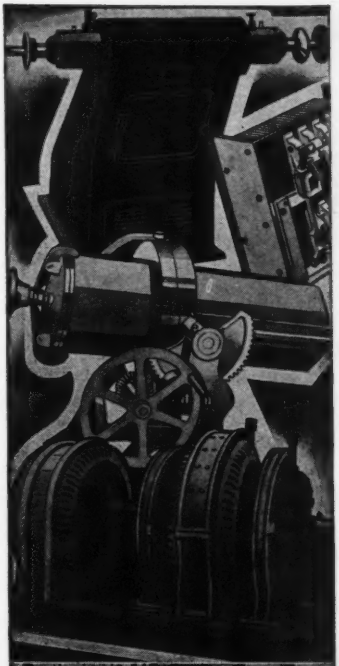
To make the Review more useful I bought at the 5 & 10 Stores a box of 3″ x 5″ cards and index to file the titles of the papers and abstracts of the Review. In the way of a suggestion I harbored the thought, if it were possible to print the abstracts on a page, the back of which would be advertisements; then the abstract could be cut out and pasted on the cards and filed. This would be very convenient for the Plater and laboratory. I wonder what other Platers are thinking?

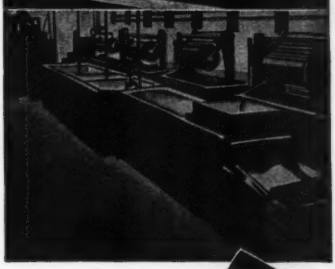
Another point I would like to bring to your attention:

Authors of papers very often would appreciate a copy of the Review containing their paper. Our society does not make any provision for this either for members or non-members. Here again, only I have not thought of the expense, if it could be arranged it might be well to print a few copies of one's paper and put the Reviews cover on it for the author. This would interest authors who are not members and be a sort of compensation, or we might send him a few copies of the Review of that issue.

For the success of the Review, Yours very truly,

ALBERT HIRSCH.





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To the Officers and members of the American Electro-Platers' Society:

Greetings!

In forming the different committees for the year, I have endeavored to make them as representative of every branch of our organization as is possible. I will ask all them members of these different committees to enter into their work with an open mind, which will be guided by the facts that are brought out and that their actions will be for the good and welfare of our organization. I will ask that the different decisions be as harmonious as possible Then when we convene in convention again we will know that the year has been one of real progress for the A. E. S.

One of the important committees is the Membership Committee. To have an organization we must have members. When approaching prospective members to join our organization there can only be one answer from anyone who is interested in electroplating or any electro-chemical work, for no other organization fills this field like the A.E.S. Anyone interested in electro metallurgy cannot afford missing the advantages derived from membership in our organization. I have asked Mr. Joseph Underwood, our first vice president, to head the membership committee and have appointed all the branch secretaries as his co-workers.

Another important committee is the Educational Committee. Mr. Thomas Slattery has consented to head this committee. With the experience he has gained in the last few years, we know that this committee will be ably directed. To assist him with the educational work I have appointed all the Librarians to this committee.

Mr. W. M. Phillips has accepted the chairmanship of the Research Committee and Mr. Walter Fraine has consented to remain as secretary-treasurer. They will be assisted by the following:

Mr. Van Winkle Todd, Hanson, Van Winkle Munning Co.
Mr. R. L. Suhl, International Nickel Company.
Mr. Erwin Sohn, Standard Sanitary
Mr. D. J. McGar, Chase Companies
Mr. Chas. Meyes, General Electric Co.
Mr. Geo. B. Hogaboom, Hanson, Van Winkle-Munning Co.
Mr. Sexton, Sargent Company
Mr. Carl Heussner, Chrysler Corporation
Mr. Claude S. Tompkins, J. B. Ford Company
Dr. Wm. Blum, U. S. Bureau of Standards.

A resolution was passed at the 1934 Convention that a committee be formed to investigate the conditions and qualifications of membership and to make a recommendation to the Executive Board within six months. A referendum vote to be taken on the matter before the next convention.

Knowing that this membership question is of such importance to the organization and that we cannot afford to jeopardize harmony in our ranks by any one-sided action, I feel that this committee should be as representative as possible. I therefore appoint all Branch Presidents to this committee. I will ask that they diligently inquire the view of our members on this important matter.

A questionaire will be compiled which will be approved by the Executive Board before it is sent to the Branch Presidents for them to get the expressions of our members on these important questions. These expressions will then be formulated for the referendum vote which will be taken later.

Sincerely,

H. A. GILBERTSON.

CLEVELAND BRANCH

The regular monthly meeting of the Cleveland Branch was held at Hotel Carter. The meeting was called to order by our President, Mr. R. T. Scott. The minutes of our June meeting were approved as read.

An application was sent to Dr. Coats of the Firestone Tire and Rubber Company but no reply was received from him. There being no applications or ballotting for new members the meeting went on to the Reports of the Delegates to the Convention. Mr. Singler and Mr. Thompson gave very interesting talks on the Convention and the things happening there, and also of their visit to the Ford plant and Greenfield Village, after which they were given a rising vote of thanks. Mr. Thompson then told us that the Convention in 1936 would most likely be held in Cleveland, so that we have ample time in two years in which to plan for it and make it a big success. A letter from our Supreme Secretary in reference to our financial condition, was ordered filed.

Our Secretary then gave an oral invitation from The Platers Trade Association, Cleveland branch of the Master Platers Institute, to attend a picnic at the Duke of York roadhouse on Broadview Road, as their guests. Then there were some moving pictures shown by Mr. Thompson and Mr. Lyons. One reel was on liquid air, the other on electric light bulbs, both of which were very interesting, after which they were given a rising vote of thanks.

On a motion made by Mr. Singler and seconded, the September meeting was to be held on the 8th instead of the 1st, on account of the date being so close to Labor Day. There being no further business and the time being late a motion was made to adjourn.

W. E. O'BERG, *Sec.-Treas.*

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held August 11, 1934 at the Atlantic Hotel. President E. G. Stenberg presiding and all other officers present.

Mr. W. J. Rauen was elected to active membership.

At our July 14 meeting Mr. J. Hay and Mr. J. Lockerbie presented their paper on "What Effect has the Shape of an Article to be Plated on Throwing Power." This was illustrated by slides the same as when it was presented at the Convention and both of these members are to be congratulated on this fine piece of practical knowledge contributed by this paper to the plating fraternity.

Mr. F. J. Hanlon read the Delegates convention report which was very interesting and well received by those present.

Mr. C. R. Crawford was elected an active member at the July meeting.

Mr. O. E. Servis presented Mr. C. Clindinin of Chicago Branch the certificate of Award won by his paper during the year 1933 to 1934. Mr. Servis in a few well chosen words complimented Mr. Clindinin and also told the rest of the members present to take due notice and try to win a certificate and the medal this year for the glory of Chicago Branch.

The librarian found the following questions in the question box.

No. 1. *Is there any chemical that will produce bright nickel in barrel plating other than cadmium?*

Ans. Many other additions suggested but thought that Cadmium Chloride used 1 oz. to 100 gal. would work best.

No. 2. *What would cause pitting in an Acid Copper solution?*

Ans. The most common cause is not sufficient acid.

No. 3. *What is a good brightener for a Zinc cyanide solution?*

Ans. Cyanide of mercury brightner.

No. 4. *Of what value is Tri-Chlos Acetic Acid in testing Nickel deposit on brass?*

Ans. When thin or porous deposits of Nickel are on brass the spots will show blue.

No. 5. *How is the oxidized or gun metal finish produced on telephones?*

Ans. Muriatic acid 1 gal., Arsenious acid 4 oz., Iron filings 4 oz. Use steel or iron anodes and low current.

No. 6. *What is the best way to control carbonates in a heavy depositing cyanide copper solution?*

Ans. Add. Lime or Barinum Hydroxide.

No. 7. *How can the aluminum base die castings be ball burnished satisfactorily?*

Ans. Any non-attacking soap solution will give good results.

J. W. HANLON, *Sec.-Treas.*

BRIDGEPORT BRANCH

The regular meeting of the Bridgeport Branch was held in the Chamber of Commerce Rooms of the Stratfield Hotel on Friday, August 4. There were twenty-five members present. Al. Rosenthal presided.

Arrangements were in progress for an Annual Outing to be held on September 15.

Ray O'Connor, Chairman of the Committees arranging for the Convention to be held in Bridgeport next year, reported that such business is in progress. Mr. Meyer, a new member, is contemplating the issue of a paper on the convention. There is an urgent call that all of the New England branches assist the Bridgeport Branch in making the Convention a success. Mr. Stratton, Mr. Norgren and Mr. Oberender spoke concerning the convention.

The application of Mr. W. R. Meyer of the General Elec. Co. was received and he was elected a member.

All bills were ordered paid. Treas. report was read and accepted. Meeting adjourned at 10:00.

WILLIAM H. FLAHERTY, *Sec'y-Treas.*

MILWAUKEE BRANCH

The regular meeting of Milwaukee Branch was held at Lipps Hall, N. 3rd and W. Highland Ave. on Thursday evening, Aug. 9, 1934. Vice-President Dexter Rhodes called the meeting to order. After a short business meeting Librarian Henry Binder took charge of the educational meeting. Al. J. Hermansen, delegate to the Detroit convention, reported on some of the papers presented at the Convention. Librarian H. Binder expects to have some very interesting data on bright nickel at our next meeting in September. We are hoping some other members who have had some experience on bright nickel will help us.

FRANK J. MARX, *Sec'y.*

WATERBURY BRANCH

Waterbury Branch held its regular monthly meeting, Friday August 10th, in Engineers Hall. In deference to the warm weather, the meeting was of short duration. A resume of some of the papers read at the recent convention was discussed and commented upon.

An itemized report received from V. E. Grant, secretary of the recent

Hartford-Bridgeport and Waterbury Banquet, held in Hartford, was read and proved to be a success in every respect.

Henry Mahlsteadt, a member of the local Branch, has been granted rights on a process of chromium plating, same being assigned to the United Chromium Corporation.

The local papers inform us that Archie J. MacDermid, a member of the local Branch, has returned from a salmon fishing trip spent on the Jupiter River in Anticosti. On the return trip, Archie and his party flew from Anticosti Island to Montreal.

W. F. GUILFOILE, *Secretary.*

NEW YORK BRANCH

A regular meeting of New York Branch was held on Friday, July 13. In line with the professed efforts of the officers to start the meetings early, considerable ground was covered and we were into Good and Welfare by 9 P.M. There were plenty of lively discussions on a variety of plating problems, despite the fact that some of our "live" members were away on their vacations. Some interesting and enlightening remarks were made on rhodium plating by Mr. Henry, who is considered an authority on rhodium plating technique. Mr. John Rolfe and Mr. Frank MacStoker reported on their visit to Mr. Phil Morningstar, and announced that he has quite recovered from his recent illness and able to return to work after a prolonged absence.

It is with deep regret that we heard of the severe illness of Mr. Martin B. Apy, one of our distinguished members. While attending the International Stereotypers and Electrotypers Convention at Detroit, Mr. Apy collapsed, and was forced to return home. The members, who know Mr. Apy find much to admire in him, and wish him a rapid recovery.

At our July 27th meeting, Mr Emil Bittener delivered an interesting paper on "Finishing Bronze and Brass Status" and other artistic work. This work was thoroughly covered by Mr. Bittener, who is considered an authority on this class of work.

A lenghty discussion was had, at our Aug. 10 meeting on the worth and advantages of patented nickel solutions, many of which are on the market at present.

Another interesting subject brought up was of an aluminum tin alloy electrodeposit, which is now being produced.

Our good friend and brother Martin B. Apy is still considered dangerously ill.

For this time of the year our meetings are unusually well attended, and it is the hope of the officers that this show of support be continued throughout the year. ARTHUR WALLACE, *Rec. Sec.*

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APPLICATIONS

	Branch
Mr. Roman C. Binder..1515 W-Atkinson Ave., Milwaukee, Wisc.	Milwaukee
Mr. J. A. Bauer,..no street address given, Philadelphia, Pa...	Phila.
Mr. Herbert J. Perry..no street address given, Philadelphia, Pa.	Phila.
Mr. Henry Bornitzke, 410 Oakland Ave., Waukesha, Wisc.....	Milwaukee

ELECTIONS

Walter Raymond Meyer, 175 Grand St., Seymour, Conn.....	Bridgeport
Carmi R. Crawford, 4534 W-North Ave., Chicago, Ill.....	Chicago
Wm. J. Rauen, 3449 Grand Blvd., Brookfield, Ill.....	Chicago

RESIGNATIONS

John Raven, 1139 Emerald Ave. N. E., Grand Rapids.....	Grand Rapids
J. F. Jordan, 202 Kimberly Ave., New Haven, Conn.....	Phila.

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Quite a few copies are returned each month marked "Unclaimed" or "Not at". The names on these copies are immediately taken out of our mailing list.

When you send a new address, please give the old address also. This is important.

The BUYERS' GUIDE

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American Brass Co., Waterbury, Conn.

Anodes, Acids and Salts

Hanson-Van Winkle-Munning Co., Matawan, N. J.

The Harshaw Chemical Co., Cleveland and large cities.

Grasselli Chemical Co., Cleveland, O.

Ball Anodes

Udylite Process Co., 3939 Bellevue Ave., Detroit, Mich.

Grasselli Chemical Co., Cleveland, O.

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Grasselli Chemical Co., Cleveland, O.

Frederic B. Stevens Inc., Detroit, Mich.

Metal Lacquers and Finishes

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Maas & Waldstein Co., 432 Riverside Ave., Newark N. J.

H. V. Walker & Co., Elizabeth N. J.

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